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EP 22615 (2)

PATENT SPECIFICATION 840,762

DRAWINGS ATTACHED.

Inventor:—JOHN HARRY TAYLOR.

Date of filing Complete Specification : July 26, 1956.

Application Date : Aug. 11, 1955. No. 23122/55.

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International Classification :—H01b, n.

COMPLETE SPECIFICATION.

Improvements in or relating to Electrical Apparatus.

We, ELECTRIC & MUSICAL INDUSTRIES LIMITED, a British Company, of Blyth Road, Hayes, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to electrical apparatus, such as radio and television receivers, and is particularly concerned with apparatus comprising an insulating panel having adhering circuit conductors to which various electrical components are connected.

It has been proposed hitherto to mount a multiplicity of socket like connectors on a substantially flat insulating panel so that all the connectors project from one side of the panel and to support various small components, such as resistances, capacitors and coils, on the opposite side of the panel by inserting the lead-in wires of the components into the appropriate connectors and thereafter soldering all the lead-in wires to the connectors simultaneously by a dip soldering process. The usual soldering process comprises supporting the panel above a bath of molten solder in spaced parallel relation to the surface of the solder and then lowering the panel to a predetermined distance above the solder such that the connectors projecting from the underside thereof dip into the solder. However, the difficulty arises that heat from the solder is liable to affect the panel, causing it to warp so that some of the connectors thereon dip too deeply into the solder and others do not reach the solder.

This difficulty is commonly experienced when large single panels are used to carry the connectors and it can sometimes be overcome by mounting the panel in a frame which holds the edges thereof substantially flat, but a frame cannot always be relied upon to maintain the whole area of a layer panel sufficiently flat to ensure that all the connectors thereon will dip into the solder. Furthermore, cheap machines for the automatic insertion of components may be limited in the size of the panel which they can accommodate.

The object of the present invention is to provide improved electrical apparatus with a view to reducing the above-mentioned disadvantages which arise when an attempt is made to dip solder a large panel.

In the present invention instead of employing a large panel a number of smaller panels are employed and are provided with means whereby such smaller panels can be readily connected to another panel to form a complete electrical apparatus.

According to one feature of the invention there is provided electrical apparatus comprising a plurality of panels of insulating material having adhering circuit conductors, at least one of said panels having components soldered to said conductors by a dip soldering process, said panels being assembled together by means which effect electrical interconnection of the circuit conductors of one panel with the circuit conductors of another panel.

According to another feature of the invention there is provided a method of forming electrical apparatus comprising a plurality of panels of insulating material having adhering circuit conductors, at least one of said panels having components applied thereto, said method comprising dip soldering said at least one panel to secure said components to conductors on said at least

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one panel, and then assembling said panels together by means which electrically interconnect the circuit conductors on said panels.

Said at least one panel is arranged to be of a sufficiently small size to enable said at least one panel to be dip soldered without the possibility of the panel or panels sagging. It will, of course, be appreciated that if desired the panel or panels may be held in a suitable frame during the dip soldering process.

Any suitable means may be provided for effecting interconnection between the circuit conductors of one panel with the circuit conductors of another panel, and the panels may, if desired, be secured together in overlapping relationship.

The circuit conductors may be disposed on one surface of each of two panels and said panels may be assembled together in parallel relation such that said one surface of one of the two panels is adjacent said one surface of the other of the two panels. This is a particularly suitable arrangement where the panels are connected together in overlapping relation in which case the conductors on the first panel can be arranged directly to engage the conductors on the second panel. The means for interconnecting the circuit conductors may comprise plug and socket terminals, staples or eyelets or rivets associated with bridging elements if desired and preferably disposed adjacent the edges of the panels. Furthermore, if desired, one or more of the panels may be assembled so as to be at an angle to another panel. Where the panels are arranged to lie substantially in the same plane then the said means will be provided at the edges of said panels and likewise where the said panels are disposed at an angle to one another and said panels are connected together at their edges then said means will also be provided at the edges of said panels, although it is also possible in accordance with the invention to connect one panel to another panel by providing said interconnecting means along, for example, a centre line of one panel and along the edge of another panel so that two panels can be interconnected with one panel, for example at right-angles to the centre line of another panel.

In order that the present invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the accompanying drawings which illustrate examples of means by which electrical interconnection between conductors of adjacent panels may be effected.

Figures 1 to 12 are sectional views; and Figure 13 is a plan view of such adjacent panels.

Typical electrical apparatus may, for example, comprise a sheet of insulating material sold under the Registered Trade Mark "Paxolin" and measuring $15'' \times 15'' \times {}^{1}/_{16}''$, and such a sheet is divided into three equal panels each measuring $5'' \times 15'' \times {}^{1}/_{16}''$. Each panel is provided with adhering circuit conductors which may be formed by printed circuit, electro-deposition or similar technique, the circuit conductors having eyelets or the like by means of which components can be connected to the circuit conductors by their lead-in wires. The eyelets may be separately applied to the panel or may be formed by electro-deposition such as by spraying the walls of apertures in the panel with a silver coating and employing the coating as an electrode during the electro-deposition of a metal such as copper. Each panel may then be mounted in a frame so as to be held substantially flat thereby, and the three panels may be subjected separately to a dip soldering process to connect said components to said conductors, and may then be assembled as hereafter described. If desired such panels may be mounted side by side in a common frame having two intermediate supporting members whereby all of the longitudinal edges of the panels are supported, and may be subjected simultaneously to a dip soldering process. The use of a frame or frames to maintain the panels substantially flat during the dip soldering process permits panels of substantial length in one dimension to be used, thereby reducing the number of panels required.

The accompanying drawings illustrate various ways in which said panels can be assembled to interconnect the circuit conductors of one panel to another panel. In the drawings references 1 and 2 indicate two adjacent panels prepared as described, having circuit conductors respectively indicated by references 3 and 4. In Figure 1 connection between the conductors 3 and 4 is made by conducting sockets and plugs 5 and 6 which are engaged in apertures in the panels 1 and 2 and are connected to the conductors 3 and 4 when the panels are dip soldered. The two sections can then readily be assembled by causing interengagement of the sockets 5 with the plugs 6. Instead of using sockets and plugs as shown in Figure 1, the panels 1 and 2 as shown in Figure 2 can each be provided with an aperture having an eyelet 7 connected to circuit conductors 3 and 4 and the latter are interconnected by means of U-shaped conducting bridges 8 which may be formed of wire, the limbs of which can be connected to the eyelets 7, by soldering, for example dip soldering, such soldering being effected subsequently to the dip soldering of the individual panels referred to

above, alternatively the limbs may be bifurcated and engage the eyelets 7 by spring pressure. If desired as shown in Figure 3 any or all of the bridges 8 may include a circuit component, in which case the limbs of said any or all bridges may be formed by the lead-in wires of conventional components.

In Figures 1 to 3 the panels 1 and 2 are assembled in the same plane but if desired the panels can be otherwise disposed as for example perpendicular to one another. Figures 4 to 7 illustrate examples in which the panels 1 and 2 are disposed perpendicular to each other and the conductors 3 and 4 are interconnected either by plugs 10 and sockets 11 as shown in Figure 4, by a plug 12 and eyelet 13 as shown in Figure 5, by bridges 14 which can be soldered to eyelets 15 as shown in Figure 6, said bridges 14 including if desired an electrical component 16 as shown in Figure 7.

The panels may be assembled with their edges overlapping as shown in Figures 8 and 9. In Figure 8 each panel is provided with an aperture having an eyelet connected to a circuit conductor on the respective panel. Thus as shown panel 1 has an eyelet 17 and panel 2 has an eyelet 18. The panels 1 and 2 are arranged so that the said eyelets 17 and 18 lie one above the other and a pin 19 is inserted within said eyelets 17 and 18 and soldered thereto so as to provide the required interconnection between the circuit conductors 3 and 4. In Figure 9 the panels are secured together by common eyelets 20 engaging apertures in the panels, said eyelets being in electrical engagement with the conductors 3 and 4. When the panels are assembled together in overlapping relation, the circuit conductors on said panels may be provided on the surfaces thereof adjacent each other in the overlapping region. This has the advantage that a circuit conductor on one panel can then be arranged to be in direct contact with a circuit conductor on another panel. This is shown in Figure 11 which will be described in more detail hereinafter.

In Figure 10 interconnection between the conductors 3 and 4 is made by conducting pointed members 21 and 22 which are forced through the panels 1 and 2 respectively and engage in the material of said panels with the pointed ends in contact with the conductors 3 and 4, said members being connected together by means of a bridging member such as a flexible conductor 23 which may, for example, be of insulated wire. In Figure 11 the two panels are disposed in overlapping relationship with the conductors 3 and 4 adjacent to each other and the interconnection is made by the application of solder 24. If desired a pointed member may be provided passing through the two panels. In Figure 12 the circuit conductors of one panel are connected to the circuit conductors of an adjacent panel by means of staples 25 the pointed ends of which are forced through the panels into contact with the conductors 3 and 4, the ends being bent over the conductors if desired.

Figure 13 shows a plan view of the two panels 1 and 2 of which the adjacent edges are provided with a plurality of projections by being castellated, the castellations of the two panels interengaging to assemble said panels. With such a construction the panels may be connected together at any desired angle and the circuit conductors 3 and 4 may be soldered together.

As mentioned above the invention is particularly applicable to apparatus having an adhering electrically conducting pattern of the circuit wiring formed thereon by a printing process, a photographic process or a plating process or the like. The circuit wiring may be formed for example by the process described in Patent Specification No. 602,492.

Frequently electrical apparatus includes both low frequency and high frequency circuits. For low frequency applications the conductors can be in the form of copper foil bonded to a carrier of thermo-setting resin such as melamine and supported on a panel of resin bonded fibre. For high frequency applications however, commonly employed thermo-setting resins have poor electrical properties and hence for these applications the conductors are preferably bonded to polyethylene which may be supported on a panel of resin bonded paper. A panel suitable for low frequency application and a panel suitable for high frequency application may be separately processed initially where the desirable conditions of processing differ and may then be connected electrically by any of the methods hereinbefore described with reference to the drawings and subsequently processed as a unitary whole where the processing conditions for the two panels are identical.

In a further application of the invention portions of electrical apparatus may be prepared in different manners. For example a panel or panels thereof may have conductors deposited thereon by means of an inexpensive process such as silk screen printing, whilst other panels have conductors provided such as by plating on both sides of the panel, and further panels of the apparatus comprising radio frequency coils, for example, may be prepared by means of a high definition photographic process. The conductors of the separate panels may subsequently be interconnected as previously described.

Yet again one panel of electrical appara-

tus may for example have polythene as a carrier, when it would be necessary to dip solder the conductors thereof under carefully controlled conditions of time and temperature in order not to melt the polythene. Another panel however, may comprise circuit conductors provided on both sides of the panel and interconnected through apertures in the panel, in which case a prolonged dip in solder at a higher temperature would be required. Connection between such panels may subsequently be effected by the means shown in Figure 2, 3, 10 or 13 for example.

It may be desirable to employ different conducting materials for different portions of electrical apparatus. For example aluminium is less expensive than copper and is suitable for circuits where ohmic resistance is unimportant. Conducting materials having an even higher specific resistance are suitable for circuits where a high resistance is required such as for mains voltage drop. The different conducting materials require different processing and different fluxes and even solders of different compositions. Thus the different conductors may be mounted on separate panels and be subsequently interconnected by bridges which are of such composition that they form good solder connections with the different conductors, or by plugs and sockets, for example, of such compositions that one thereof will solder well to one conducting material whilst the other will either solder well to the other conducting material or will permit a good mechanical connection thereto.

In the mounting of the components of the apparatus on the panels, initially certain small and light components such as resistors may be automatically applied to one panel and the panel soldered to retain them. Subsequently heavy components, such as transformers, may be attached by rivets or nuts and bolts to another panel and the two panels may be connected together by bridges or pointed members as shown in certain figures of the accompanying drawings.

Frequently it is most convenient and inexpensive to employ a circuit component as a bridge piece, as shown in Figures 3 and 7 especially when the component is of awkward shape for mechanical insertion, or where it has an insulation with a low melting point and so requires a carefully controlled solder dip.

WHAT WE CLAIM IS:—

1. Electrical apparatus comprising a plurality of panels of insulating material having adhering circuit conductors, at least one of said panels having components soldered to said conductors by a dip soldering process, said panels being assembled together by means which effect electrical interconnection of the circuit conductors of one panel with the circuit conductors of another panel.

2. A method of forming electrical apparatus comprising a plurality of panels of insulating material having adhering circuit conductors, at least one of said panels having components applied thereto, said method comprising dip soldering said at least one panel to secure said components to conductors on said at least one panel, and then assembling said panels together by means which electrically interconnect the circuit conductors on said panels.

3. Apparatus according to Claim 1 or a method according to Claim 2 wherein said panels are assembled together with adjacent edges in overlapping relationship.

4. Apparatus of a method according to Claim 3 wherein the circuit conductors are provided on one side of each of said one panels and said one sides are adjacent each other in the overlapping region of said panels.

5. Apparatus according to Claim 1 or a method according to Claim 2, wherein said panels are assembled together at an angle to one another.

6. Apparatus according to Claim 1, 3, 4 or 5, or a method according to Claim 2, 3, 4 or 5, wherein said means for electrically interconnecting said circuit conductors comprises plug and socket members.

7. Apparatus according to Claim 1, 3, 4 or 5 or a method according to Claim 2, 3, 4 or 5, wherein said means for electrically interconnecting said circuit conductors comprises members having limbs which pass through apertures in said panels, said apertures preferably having eyelets.

8. Apparatus according to Claim 1, 3, 4 or 5 or a method according to Claim 2, 3, 4 or 5, wherein said means for electrically interconnecting said circuit conductors comprises pointed members which are forced through said panels, so as to engage in the material of said panels.

9. Apparatus according to Claim 1, 3, 4 or 5 or a method according to Claim 2, 3, 4 or 5, wherein said means for electrically interconnecting said circuit conductors comprises staples.

10. Apparatus according to Claim 1, 3, 4 or 5 or a method according to Claim 2, 3, 4 or 5, wherein said means for electrically interconnecting said circuit conductors comprises a circuit component the lead-in wires of which engage with the conductors of adjacent panels, or with eyelets connected to said conductors.

11. Apparatus according to any of the preceding Claims 1, or 3 to 10, or a method according to any of the preceding Claims 2 to 10, wherein said panels are composed

of different insulating materials or are panels which are differently processed.

12. Electrical apparatus comprising a plurality of panels having adhering circuit conductors with the circuit conductors of one panel interconnected with the circuit conductors of an adjacent panel in any of the manners substantially as described with reference to any of the figures of the accompanying drawings, or modified as herein described.

13. Electrical apparatus when made by a method according to any of the preceding Claims 2 to 11.

F. W. CACKETT,
Chartered Patent Agent.

Reference has been directed, in pursuance of Section 8 of the Patents Act, 1949, to Specification No. 739,828.

PROVISIONAL SPECIFICATION.

Improvements in or relating to Electrical Apparatus.

We, ELECTRIC & MUSICAL INDUSTRIES LIMITED, a British Company, of Blyth Road, Hayes, Middlesex, do hereby declare this invention to be described in the following statement:—

This invention relates to electronic apparatus, such as radio receivers and television receivers, and is particularly concerned with apparatus of this kind which is provided with a chassis comprising an insulating panel carrying a multiplicity of connectors that are interconnected by the circuit conductors of the apparatus and serve to support various electrical components by their lead-in wires and to couple the components to the circuit conductors.

It has been proposed hitherto to mount a multiplicity of similar socket-like connectors on a substantially flat insulating panel so that all the connectors project from one side of the panel and to support various small components, such as resistances, condensers and coils, on the opposite side of the panel by inserting the lead-in wires of the components into the appropriate connectors and thereafter soldering all the lead-in wires to the connectors simultaneously by a dip soldering process. The usual soldering process comprises supporting the panel above a bath of molten solder in spaced parallel relation to the surface of the solder and then lowering the panel to a predetermined distance above the solder such that connectors projecting from the underside thereof dip into the solder but the difficulty arises that heat from the solder is liable to affect the panel, causing it to warp so that some of the connectors thereon dip too deeply into the solder and others do not reach the solder.

This difficulty is commonly experienced when large single panels are used to carry the connectors and it can sometimes be overcome by mounting the panel in a frame which holds the edges thereof substantially flat, but a frame cannot always be relied upon to maintain the whole area of a large panel sufficiently flat to ensure that all the connectors thereon will dip into the solder.

An object of the present invention is to provide an improved method of overcoming the difficulty mentioned hereinbefore.

According to the invention the insulating panel is formed in sections of a suitable size such that all the connectors on any section can be soldered simultaneously by said process and the circuit conductors on each section are arranged to terminate at or adjacent a side or sides of each section such that said panel is formed by assembling said sections edge to edge in such manner that the conductors of one section become connected to the conductors of an adjacent section or sections.

The conductors may be disposed on opposite surfaces of adjacent sections and the sides of the sections at which the conductors terminate may be arranged in overlapping relation such that the conductors on one section directly engage the conductors on another section or sections, or again, the conductors on each section may be connected to plug or socket terminals mounted on the sections adjacent edges thereof such that two sections can be joined together by disposing them side by side or in overlapping relation with the plug or socket terminals on one section coupled to the socket or plug terminals on an adjacent section.

In carrying out the invention the insulating panel will be cut into two or more sections of suitable small size such that normal warping of a section due to the heat of the molten solder will not cause relative displacement of the connectors thereon to such an extent that they cannot all readily be dip-soldered simultaneously. The permissible size of the sections may vary according to the thickness of the material and its composition and according to the length of the connectors. In an actual embodiment of the invention a panel was used comprising a rectangular sheet of insulating material sold under the Registered Trade Mark "Paxolin" and measuring 15" × 15" × 1/16" and it was found convenient to divide this

panel into three equal sections measuring 5" × 15" × 1/16". Each section was mounted in a frame so as to be held substantially flat thereby and the three sections were subjected separately to the dip soldering process and then assembled together to form the complete insulating panel. If desired, the sections of a panel can be mounted side by side in a common frame and subjected simultaneously to the dip soldering process.

It is to be noted that the use of a frame or frames to maintain the sections substantially flat during the dip soldering process permits sections of substantial length in one dimension to be used, thereby reducing the number of sections required.

The invention is particularly applicable to electronic apparatus provided with an insulating panel having an adhering electrically conducting pattern of the circuit wiring formed thereon by a printing process, a photographic process or the like. The circuit wiring may be formed, for example, by the process described in Patent Specification No. 602,492. The invention may also be used in association with insulating panels carrying other forms of circuit wiring such as, for example, the kind of electrical circuit described in the Specification of Patent Application No. 3983/54 (Patent Specification No. 782,739).

F. W. CACKETT,
Chartered Patent Agent.

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Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
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COMPLETE SPECIFICATION

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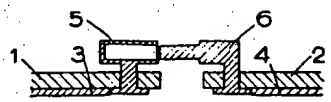

FIG. 1.

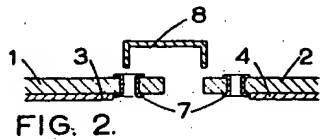

FIG. 2.

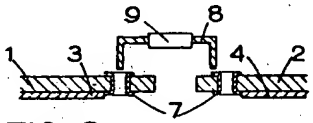

FIG. 3.

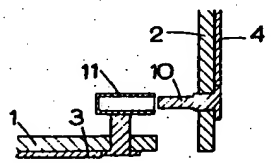

FIG. 4.

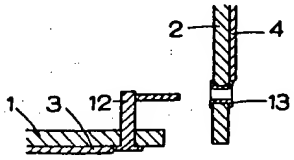

FIG. 5.

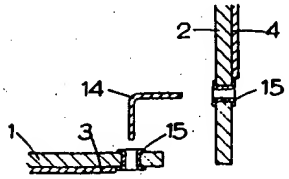

FIG. 6.

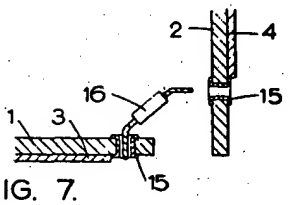

FIG. 7.

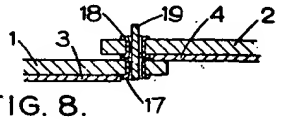

FIG. 8.

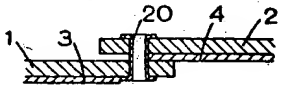

FIG. 9.

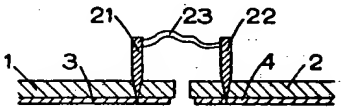

FIG. 10.

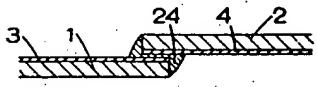

FIG. 11.

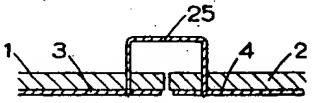

FIG. 12.

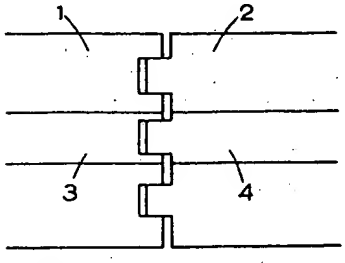

FIG. 13.

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